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Applicant(s): Ma Shipping	
Application No.: 10/004,978	
Filed: 12/3/2001	Group Art Unit: 1711
Title: Flame Retardant Resin Composition and Molded Products Thereof	Examiner: U. Rajguru
Attorney Docket No.: GEPL.P-080	

BRIEF FOR APPELLANT

This brief is filed in support of Applicants' Appeal from the final rejection mailed 9/20/2004. Consideration of the application and reversal of the rejections are respectfully urged.

Real Party in Interest

The real party in interest is General Electric Company.

Related Appeals and Interferences

To Applicants' knowledge, there are no related Appeals or Interferences.

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Status of Claims

Claims 1-21 are pending in this application and are the subject of this appeal. No other claims have been presented.

Status of Amendments

All amendments have been entered.

Summary of Claimed Subject Matter

Polycarbonate resin compositions are useful in various applications, including in applications where it is desirable to have both high impact resistance and nonflammability. (Page 1, lines 11-17). Polycarbonate has high impact resistance, but is not nonflammable. When additives are added to reduce flammability, however, the impact resistance may be degraded, and other undesirable properties may also be introduced. (Page 1, line18-Page 6, line 22). Therefore, a general goal in formulating resin compositions is to obtain the best result in terms of target properties, while maintaining to a maximum extent the desirable properties of the base resin. In the present case, the goal of the application is a composition that is nonflammable, heat resistant and hydrolysis resistant while retaining high impact strength. (Page 7, lines 4-6).

The present application achieves this goal by providing a polycarbonate-based nonflammable resin composition. As set forth in the claim 1, the composition comprises a polycarbonate-based resin (Page 9, line 28-Page 14, line 6), a phosphoric ester conforming to a specified general formula (Page 19, line 25-Page 21, line 13), and an alkoxy group-containing organopolysiloxane of specified structure. (Page 21, line 14-Page 25, line 13). In the composition as defined in claim 1, the amounts of phosphoric ester and the organopolysiloxane are specified relative to the amount of the polycarbonate-based resin. Independent claim 2 corresponds to claims 1, but also specifically recites an additional thermoplastic resin component. (Page 14, line 3- Page 17, line 18) Evidence presented in the specification (Examples and Page 22) and in the Declarations Under Rule 132 filed during prosecution and

attached in the evidence appendix show the importance of the specific components in achieving this result.

Grounds of Rejection to be reviewed on Appeal

Claims 1, 2, 4-11, 16-19 and 21 are rejected as obvious under 35 USC § 103 over Yamamoto et al. (US 6,184,312) in view of Fuhr et al. (US 5,658,974). Claims 3, 12-15 and 20 are rejected over this combination of references plus additional references. As they are dependent claims with the same effective filing date as the claims from which they depend, they are not properly rejected for obviousness, if the rejection of the independent claim is overcome. *In re Leavell*, 212 USPQ 762 (POBA 1981) Thus, only the one ground of rejection is argued in this Appeal.

Argument

The Examiner has rejected the claims under 35 USC § 103 as obvious over the combination of US Patent No. 6,184,312 (Yamamoto) and US Patent No. 5,658,974 (Fuhr) alone or in combination with additional references. The Examiner contends that all of the elements of claim 1 are met by Yamamoto, except the phosphoric ester now claimed, and that the use of Fuhr's phosphoric ester in Yamamoto's composition would have been obvious.

No Prima facie case of Obviousness has been presented

"Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination." *Carella v. Starlight Archery and Pro Line Co.*, 804 F.2d 135, 140, 231 USPQ 644, 647 (Fed. Cir. 1986). Stated differently, "citing references which merely indicate the isolated elements ... are known is not a sufficient basis for concluding that the combination of elements would have been obvious." *Ex Parte Hiyamizu*, 10 USPQ 2d 1393, 1394 (POBAI 1988). There must be both a motivation in the art, not in the application under examination, to make the modifications necessary to arrive at the claimed invention.

The Yamamoto reference relates to flame retardant resin compositions that contain an aromatic polycarbonate or epoxy resin, and a minor amount of an organosiloxane containing phenyl and alkoxy radicals. (Yamamoto, Abstract). In these compositions, the organosiloxane is said to provide flame retardance and drip inhibition, while maintaining optical transparency. The organosiloxane is used in place of other flame retardant additives such as halogens, phosphorus and antimony. (Yamamoto, Col. 3, lines 7-12). The patent discloses addition of conventional additives, but does not include additional flame retardants other than certain sulfonates in the list. (Yamamoto, Col. 8, lines 25-64).

The Fuhr reference relates to flame-proofed thermoplastic polycarbonate molding compositions. The compositions contain polycarbonate, an optional thermoplastic copolymer, a graft copolymer, a silicone resin, and a phosphorous compound or mixture of defined type. (Fuhr, Col. 2, line 34-Col. 3, line 47). In Fuhr, the phosphorus compound is added as a flameproofing agent. (Fuhr, Col. 8, line 64- Col. 9, line 20). No independent flameproofing activity is ascribed to the silicone resin employed in the Fuhr reference. There is, however, a teaching that the combination of Fuhr's phosphorous compounds and Fuhr's silicone resin result in compositions that are self-extinguishing without the production of burning droplets. (Col. 2, lines 16-19). Fuhr shows the importance of the presence of both the silicone resin and the correct type of phosphorus compound through a series of examples. For example, Example 3 of Fuhr and Comparative Example 3 of Fuhr differ in the nature of the phosphate, yet one has a burn out time of 36 sec, while the other has a burn out time of 160 sec. Longer burnout times of 60 or 74 sec are observed when the silicone resin is omitted as well (Fuhr; Comp Examples 1 and 2).

Relying on Yamamoto as a primary reference, the Examiner argues that it would have been obvious to add the phosphorous compound of Fuhr to the composition of Yamamoto, in order to obtain a composition that is self-extinguishing. Applicants submit that this proposed modification is not consistent with the references, and therefore fails to meet the standards required for support of an obviousness rejection.

As a first matter, Yamamoto specifically refers to exclusion of phosphorus as a flame retardant. Since it is phosphorous compounds, not phosphorus *per se*, that are used in the art as flame retardants, this portion of Yamamoto is fairly understood as a teaching away from the combination that the Examiner asserts would have been obvious. Furthermore, while Yamamoto mentions organosulfones as possible supplemental flame retardants, phosphorous compounds are not mentioned. Thus, there is no apparent suggestion in the art itself to make the combination proposed by the Examiner.

Furthermore, Fuhr does not teach that the phosphorus compounds by themselves are sufficient to result in a composition that is self-extinguishing. Rather, Fuhr teaches that the combination of specific types of phosphorus compounds and specific types of silicone resins produce this result. The phosphorus compound alone is not sufficient (Fuhr, Table 3, Comparison 1 and 2), yet the Examiner has selected transfer of just this component as supposedly obvious without considering whether or not the silicone resin of Fuhr is similar to the siloxane of Yamamoto.

The silicone resin of Fuhr and the organosiloxane of Yamamoto have different properties. The substituent groups specified in the formulas are different or present in different relative amounts. The silicone resin of Fuhr is a solid. (Fuhr, Col. 8, lines 11-12). In contrast, organosiloxanes 1-8 and 10 of Yamamoto are all liquids. Organosiloxane 9 of Yamamoto which is said to be a solid is used only in a comparative example, and achieves only a V1 rating in the UL-94 flame retardance test. Thus, the Examiner has not provided any reason why the person skilled in the art would expect the organosiloxane of Yamamoto to provide the same type of interaction with phosphorus compounds as the silicone resin of Fuhr.

For these reasons, Applicants submit that the Examiner has failed to identify the motivation in the art to modify Yamamoto by adding to the Yamamoto compositions a phosphorous compound as described in Fuhr.

The combination of references looks somewhat more plausible if one takes Fuhr as the primary reference, and considers using the organosiloxane of Yamamoto in place of the silicone resin of Fuhr, since Fuhr contains no negative teaching against the use of phosphorus. However,

this rejection still suffers because the Examiner has made no apparent consideration of the differences between the organosiloxane and the silicone resin, and thus no reason why a person skilled in the art would consider them to be interchangeable. Moreover, as set forth in the following section, as compared to the compositions using a Fuhr type silicone resin, the compositions of the invention provide substantial and unexpected benefits.

The Invention Exhibits Unexpected Results

Fuhr is the closest prior art

As discussed above, Applicants submit that the structure of the rejection in this case is wrong, because it treats Yamamoto rather than Fuhr as the closer art. As will be discussed below, this is significant when it comes to consideration of the declaration evidence. The elements of the claim 1 and of the cited references can be summarized in tabular form as follows:

Component	Claimed Invention (Claim 1)	Yamamoto	Fuhr
polycarbonate resin	not limited	not limited	not limited
phosphoric ester	specific structure in claims	none disclosed	overlaps with claimed structure but is not coextensive
organosiloxane	$R^1_a Si(OR^2)_b O_{(4-a-b)/2}$ $0.2 \leq a \leq 2.7$; $0.2 \leq b \leq 2.4$; and $a + b < 3$,	overlaps with claimed siloxane but is not coextensive, no specific example within scope of Applicant's claims because of vinyl at R3	different siloxane

As can be seen, like the claimed invention, Fuhr discloses a polycarbonate composition with both a phosphoric ester and a siloxane. The siloxane is different, however, from that which is presently claimed. In contrast, Yamamoto's compositions contain polycarbonate and a siloxane

that overlaps but is not identical to the that claimed, but no phosphoric ester. Thus, Fuhr is believed to be the closest of the cited prior art, and Applicant's declarations therefore report comparisons of the claimed invention with Fuhr.

Contrary to recognizing Fuhr as the closest prior art, the Examiner asserts that tests need to be made to see if "synergism exists between the phosphoric (sic) esters of Fuhr and the siloxanes of Yamamoto." (Advisory Action, 2/15/2005) This, however, would amount to comparing the invention with the invention, and not with any prior art. Only a comparison with prior art is required, and in any event, it is not seen how the test generally proposed by the Examiner would have any meaning. In the present case, comparative example 7 in the application is essentially representative of Yamamoto, since it contains siloxane with no phosphorus compound. The additional data compares the other reference to the claimed invention.

Declaration Evidence Shows Unexpected Results

Applicants have submitted two declarations under Rule 132, and copies of these are attached in the evidence appendix. The data from all of the tests is summarized in the following table:

	Exam 1.	Exam 2.	Comp Exam 1	Comp Exam 2	Comp Exam 3	Comp exam 4
Polycarbonate(A1)	84	84	84	84	84	84
ABS(A2)	10	10	10		10	10
BPADP (B)	4		4		4	
RDP		4		4		4
Silicone(C1)	1	1				
FS1			1	1		
PTFE (D)	0.5	0.5	0.5	0.5	0.5	0.5
Impact resistance IZOD (kg-cm/cm)	50	50	80	70	77	65
Deflection temperature under loading (deg C)	111	108	113	110	113	110
Initial PC molecular weight	45000	45000	45000	45000	45000	45000
After aging PC molecular weight	43000	37000	43000	37000	43000	37000
Burn time of 1.5mm thickness sample UL94(Sec)	38	25	70	60	80	65
UL rating	V-0	V-0	V-1	V-1	V-1	V-1

The data can be divided into three groups. Examples 1 and 2 contain both a silicone and a phosphorous compound (BPADP or RDP) in accordance with the invention. Comparative examples 1 and 2 have a silicone as described in Fuhr (FS1) and a phosphorous compound (BPADP or RDP) in accordance with the invention. Comparative examples 3 and 4 have a phosphorus compound (BPADP or RDP) in accordance with the invention, but no silicone. As is apparent, the otherwise comparable samples of the invention, differing only in the type of

siloxane (silicone), have better flame ratings, and much shorter flame out times when the combination is in accordance with the invention, as opposed to using the siloxane of Fuhr or no siloxane at all. This can not be attributed to the flame retardant properties of the silicone, since as shown in Comparative Example 7 in the Table of the present application (Page 32), the flammability rating and burn out time of a composition containing the siloxane but no phosphorous compound are poor. Furthermore, the result cannot be attributed to the combination of phosphorus compound and just any siloxane, since Comparative Example 4 shows a siloxane outside the scope of the present claims (no phenyl groups on the silicon atom) and this example has only a V1 flame rating, not the desired V0.

The Examiner has suggested that the data reported in the second declaration is inconsistent with that reported in Fuhr. It should be noted, however, that the comparison must be made between appropriate samples when considering the data presented in Fuhr. For example, the data in the present case uses tests on 1.5 mm thick bars. Fuhr presents data on 2.1 mm bars and 1.6 mm bars. The thinner bars do not consistently produce V0 ratings, and have longer burn times. Moreover, the test results in Fuhr all use higher levels of phosphoric ester than in the declaration, indicating that the same phosphoric ester is more effective and can be used at lower levels in the compositions of the invention.

The totality of the data in this case can be summarized as follows:


invention - specified siloxane and specified phosphorus compound	V0, short burn
specific siloxane only (Comp 7 in specification)	V1, long burn
specified phosphorus only (Comp 1 in specification; Comp 3 and 4 in Table above)	V1, long burn
Fuhr silicone resin and specific phosphorus compound (Comp 1 and 2 in Table above)	V1, long burn

The distinctiveness of the invention is apparent, and nothing in the art suggests this result.

Conclusion

For the foregoing reasons, Applicants submit that the rejection of claims 1-21 under 35 USC § 103 should be reversed.

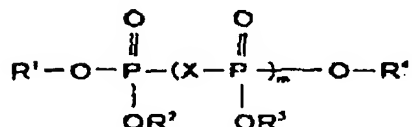
Respectfully submitted,



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Claims Appendix

1. A polycarbonate-based nonflammable resin composition, comprising:
 - a. a polycarbonate-based resin (A-1);
 - b. a phosphoric ester (B) expressed by the following formula:



where R^1 , R^2 , R^3 , and R^4 are each independently a C_1 to C_{30} hydrocarbon; X is a C_1 to C_{30} divalent organic group that may contain an oxygen atom and/or a nitrogen atom; and m is an integer from 0 to 5;

- c. an alkoxy group-containing organopolysiloxane (C) expressed by the following average compositional formula:

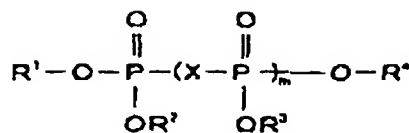
$$\text{R}^1_a\text{Si}(\text{OR}^2)_b\text{O}_{(4-a-b)/2} \dots (1)$$

where R^1 is a substituted or unsubstituted univalent hydrocarbon group containing an aryl group as an essential component; R^2 is a substituted or unsubstituted univalent hydrocarbon group; R^1 and R^2 may be the same as or different from each other; $0.2 \leq a \leq 2.7$; $0.2 \leq b \leq 2.4$; and $a + b < 3$,

wherein

said phosphoric ester (B) being contained in an amount of 0.5 to 20 weight parts and said alkoxy group-containing organopolysiloxane (C) in an amount of 0.05 to 20 weight parts per 100 weight parts of the polycarbonate-based resin (A-1).

2. A polycarbonate-based nonflammable resin composition comprising:
 - a. a polycarbonate-based resin (A-1);
 - b. a thermoplastic resin (A-2) other than a polycarbonate-based resin;
 - c. a phosphoric ester expressed by the following formula:



where R^1 , R^2 , R^3 , and R^4 are each independently a C_1 to C_{30} hydrocarbon; X is a C_1 to C_{30} divalent organic group that may contain an oxygen atom and/or a nitrogen atom; and m is an integer from 0 to 5; and

d. an alkoxy group-containing organopolysiloxane (C) expressed by the following average compositional formula:

$$\text{R}^1_a \text{Si}(\text{OR}^2)_b \text{O}_{(4-a-b)/2} \dots (1)$$

where R^1 is a substituted or unsubstituted univalent hydrocarbon group containing an aryl group as an essential component; R^2 is a substituted or unsubstituted univalent hydrocarbon group; R^1 and R^2 may be the same as or different from each other; $0.2 \leq a \leq 2.7$; $0.2 \leq b \leq 2.4$; and $a + b < 3$,

wherein

said phosphoric ester (B) being contained in an amount of 0.5 to 20 weight parts and said alkoxy group-containing organopolysiloxane (C) in an amount of 0.05 to 20 weight parts per combined 100 weight parts of the polycarbonate-based resin (A-1) and the thermoplastic resin other than a polycarbonate-based resin (A-2).

3. A polycarbonate-based nonflammable resin composition as defined in Claim 1 or 2, wherein the phosphoric ester is bisphenol A-tetraphenyl diphosphate (BPADP) or bisphenol A tetracresyl diphosphate.

4. A polycarbonate-based nonflammable resin composition as defined in Claim 1 or 2, wherein the weight average molecular weight of the alkoxy group-containing organopolysiloxane (C) is between 300 and 6000.

5. A polycarbonate-based nonflammable resin composition as defined in Claim 1, wherein the alkoxy group-containing organopolysiloxane (C) includes a branched structure.
6. A polycarbonate-based nonflammable resin composition as defined in Claim 1, wherein the alkoxy group-containing organopolysiloxane (C) contains substantially no silanol groups (SiOH).
7. A polycarbonate-based nonflammable resin composition as defined in Claim 1, wherein R¹ of the alkoxy group-containing organopolysiloxane (C) is a methyl group, ethyl group, or phenyl group, and the phenyl group content is at least 20%.
8. A polycarbonate-based nonflammable resin composition as defined in Claim 1, wherein R² of the alkoxy group-containing organopolysiloxane (C) is a methyl group or ethyl group.
9. A polycarbonate-based nonflammable resin composition as defined in Claim 2, wherein the thermoplastic resin (A-2) is one or more types of resin selected from the group consisting of:
 - polymers including as a structural component (a) an aromatic vinyl monomer component;
 - copolymers including as structural components (a) an aromatic vinyl monomer component and (b) a vinyl cyanide monomer component;
 - copolymers including as structural components (a) an aromatic vinyl monomer component, (b) a vinyl cyanide monomer component, and (c) a rubber-like polymer;
 - aromatic polyesters;
 - polyphenylene ethers;
 - polyether imides; and

polyphenylene sulfides.

10. A polycarbonate-based nonflammable resin composition as defined in Claim 9, wherein the thermoplastic resin (A-2) is one or more types of resin selected from the group consisting of ABS resins, AES resins, ACS resins, AAS resins, and polystyrene resins.
11. A polycarbonate-based nonflammable resin composition as defined in Claim 1, further comprising (D) an anti-drip agent in an amount of 0.01 to 10 weight parts per 100 weight parts of the polycarbonate-based resin (A-1) or per combined 100 weight parts of the polycarbonate-based resin (A-1) and the thermoplastic resin (A-2).
12. The polycarbonate-based nonflammable resin composition as defined in Claim 11, wherein the anti-drip agent is polytetrafluoroethylene (PTFE).
13. A polycarbonate-based nonflammable resin composition as defined in Claim 1, further comprising (E) an alkali (alkaline earth) metal salt of a perfluoroalkanesulfonic acid in an amount of 0.01 to 3 weight parts per 100 weight parts of the polycarbonate-based resin (A-1) or per combined 100 weight parts of the polycarbonate-based resin (A-1) and the thermoplastic resin (A-2).
14. A polycarbonate-based nonflammable resin composition as defined in Claim 1, further comprising (F) an epoxy-based stabilizer in an amount of 0.01 to 5 weight parts per 100 weight parts of the polycarbonate-based resin (A-1) or per combined 100 weight parts of the polycarbonate-based resin (A-1) and the thermoplastic resin (A-2).

15. A polycarbonate-based nonflammable resin composition as defined in Claim 14, wherein the epoxy-based stabilizer (F) is 3,4-epoxycyclohexylmethyl-3',4'-epoxycyclohexanecarboxylate or bis-(3,4-epoxycyclohexyl) adipate.
16. An electrical or electronic device part formed from a nonflammable resin composition as defined in Claim 1.
17. A molded article composed of a nonflammable resin composition as defined in Claim 1.
18. The composition of claim 1, wherein at least 20% of the R¹ groups are aryl groups.
19. The composition of claim 18, wherein from 50 to 90% of the R¹ groups are aryl groups.
20. The composition of claim 18, wherein the phosphoric ester (B) is bisphenol A-tetraphenyl diphosphate.
21. A polycarbonate-based nonflammable resin composition as defined in Claim 1, wherein the weight average molecular weight of the alkoxy group-containing organopolysiloxane (C) is between 300 and 2000.

Evidence Appendix

Copies of Two Declarations Under Rule 132.

Table 1		
	Exam.	Comparative example
Polycarbonate(A1)	84	84
ABS(A 2)	10	10
RDP(B)	4	4
Silicone (C1)	1	
Silicone (C2)		
Silicone (C3)		
Silicone (C4)		
Silicone (C5)		
PTFE (D)	0.5	0.5
Impact resistance	50	65
IZOD (kg ·cm/cm)		
Deflection	108	110
temperature under loading (°C)		
Initial PC molecular weight	45000	45000
After aging PC molecular weight	37000	37000
Burn time of 1.5mm thickness sample	25	65
UL94 (Sec)		
UL rating	V-0	V-1

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine.

or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

dated: Aug. 31, 2003

Ma Shipping
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Related Proceedings Appendix

none